Energy Production and Infrastructure Center (EPIC)

Johan H Enslin, PhD, FIEEE, PrEng
EPIC Director and Professor
Duke Energy Distinguished Chair

UNC CHARLOTTE

Energy Production and Infrastructure Center (EPIC)

http://epic.uncc.edu/

Charlotte Region – A Power Hub

- 260+ Energy-related with 28,000 workers in energy sector
- E^4 Carolinas, an Energy Trade Association
- 11,000 Power and Energy Engineers
- 39 Power plants in the 16 counties with 12 Nuclear reactors
- Growing renewable energy portfolio
- Several grid modernization initiatives
- Change of generation mix towards natural gas

E4 CAROLINAS

UNC CHARLOTTE

EPIC

EPIC Background

- EPIC was FOUNDED by the energy industry.
- Needed talent for the future:
  - Average age of engineers is 55+
  - Economic Development
  - Innovation in power industry
- Professional development and life-long learning of employees
- Applied research needs for a safe, reliable, and sustainable energy future.

UNC CHARLOTTE

EPIC

Founding Industrial EPIC Partners

- Duke Energy
- Siemens
- Westinghouse
- AREVA
- URS Corp
- CB&I (Shaw)
- Electric Power Research Institute (EPRI)
- Tessera
- Steag Energy Services

UNC CHARLOTTE
EPIC

EPIC Industry Advisory Board

Chairman: Dhiaa Jamil, Duke Energy, Group Executive and Chief Nuclear Officer

18 senior executives as board members from key companies:

- Duke Energy
- Steag
- AREVA
- URS/Washington,
- CB&I (Shaw), Senior Vice President
- EPRI
- Siemens Energy
- Westinghouse
- Piedmont Natural Gas
- EnergyUnited
- ABB

UNC CHARLOTTE

EPIC

EPIC Sponsors and Research Funding

EPIC Goals

- Education
  - Educate Multi-disciplinary Energy Students
  - Develop well-balanced curriculums
  - Develop Energy Concentrations
  - Program development with regional universities
- Research and Development
  - Applied multi- disciplinary research in the energy field
  - Coordinate efforts with regional and global universities

    NCSU, Clemson, USC, Georgia Tech., KIT, Delft, etc.
- Economic Development
  - Creation of energy workforce pipeline
  - Grow jobs, vendors, suppliers of energy companies.
  - Incubation of energy related startup's
  - Outreach and leadership activities

UNC CHARLOTTE

EPIC

EPIC – a successful Public Private Partnership

- State of North Carolina
  - Capital for building $ 76 M
  - 25 new Faculty and staff $ 4.5 M per annum
  - Operational budget $ 500 k per annum
- Industry Startup Support $ 17 M
- Research and grants
  - Federal and industry $10 M per annum

UNC CHARLOTTE
EPIC

EPIC Building

- The 200,000 ft^2 , $ 76 M, building opened in Fall 2012
- Unique LEEDs Gold Certified features.
- Classrooms, conference rooms, power labs, environmental labs, high bay structural lab., Smart Grid lab and offices
- Laboratories for electrical, civil, environmental and computer engineering
- Laboratory and Office for Industrial Partners
- Conference and event facilities

UNC CHARLOTTE

EPIC

EPIC Faculty

100+ EPIC associated faculty and staff across campus:

- Power Systems, Power Electronics and Smart Grid
- Power Plant Design, Metrology and Manufacturing
- Infrastructure & Environment
- Renewable Energy Systems
- Energy Markets & Systems

UNC CHARLOTTE

EPIC

EPIC Education Focus

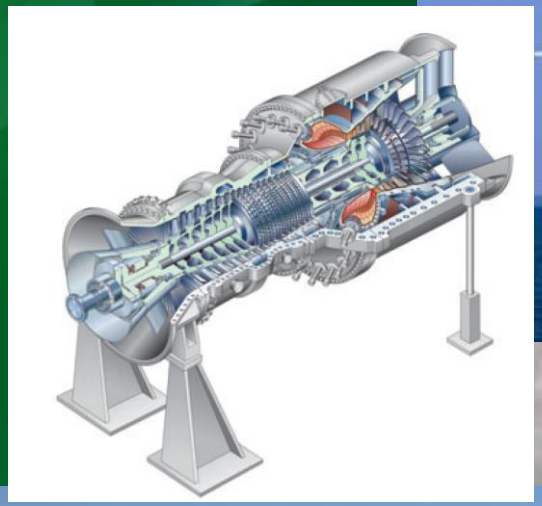
- Undergraduate Education – 350 Students taking Energy Courses
  - Energy Engineering Concentrations (100+ students enrolled)
  - Expand Co-op and Internship program
  - Undergraduate Research Assistance
  - Student participation in Leadership Academy
  - 32 Energy Senior Design Projects
  - “Introduction to Power & Energy”

- Graduate Education in Development
  - MBA with Energy Concentration, with Belk Business School
  - COE-wide MS in Applied Energy and Electromechanical Systems
  - 4 MS Concentrations in Energy Systems
  - Certifications – Energy Efficiency, Nuclear, Smart Grid, I&C, etc.
  - Energy Certification for Non-engineers
  - Graduate Research Assistance
  - Accredited short courses – PE through MS
- Coordination with Regional Universities

UNC CHARLOTTE

EPIC

EPIC Applied Research



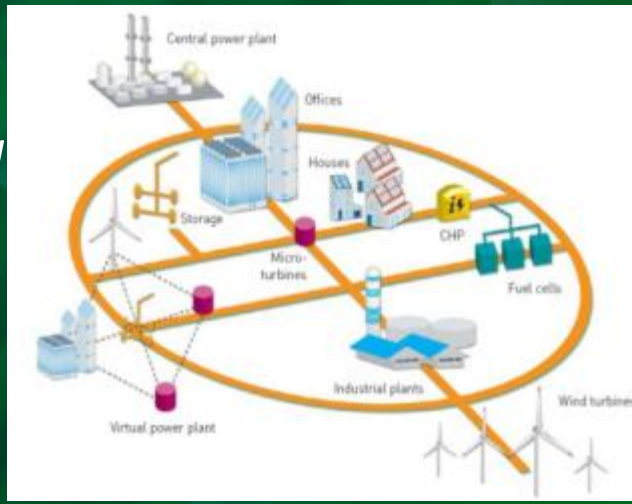
UNC CHARLOTTE

Energy Production and Infrastructure Center (EPIC)

http://epic.uncc.edu/

EPIC Applied Research Clusters (1)

- *Power Systems Modernization*
  - Duke Energy Smart Grid Laboratory with RTDS and system analysis – NSF MRI
  - Distribution Automation and Micro-grids
  - Electric Vehicle and Energy Storage Integration
- *Large Energy Component Design and Manufacturing*
  - Siemens Large-scale Manufacturing Laboratory
  - Materials Characterization Laboratory (MCL)
  - Robotics and Welding Technologies
- *Power Infrastructure & Environmental Development*
  - Large-structures laboratory and T&D designs
  - Utilization and recycling of spent fuels, air quality and water management
  - Natural –gas fracturing and infrastructure
- *Renewables and Energy Efficiency*
  - Clean-rooms with PV cell, module process and LED research
  - Off-shore wind, biomass and small-scale hydro technologies
  - Integration of renewables and energy efficiency measures
- *Energy Markets, Analytics and Systems*
  - Quality Assurance, Nuclear Safety, Regulatory, Standards
  - Distributed energy markets, analytics and operational research



UNC CHARLOTTE
EPIC

EPIC Applied Research Clusters (2)

- The Infrastructure, Design, Environment and Sustainability Center (*IDEAS*) *ideas.uncc.edu*
  - Development and utilization of biofuels
  - Natural and Built Site Design and Analysis (Green Buildings)
  - Materials Characterization Laboratory (MCL)
  - Environmental impact analysis
  - Environmental Assistance Office for Small Business (EAO)
- *Sustainable Integrated Buildings and Sites (SIBS)*
  - I/UCRC NSF Center with industry related research
  - PV integration in dense urban settings with limited roof space poor orientation, insurance issues, etc.
  - Optical collectors to guide light into PV building
  - Energy modeling for DSM, energy storage, and renewables
  - Thermal-energy storage for peak-shaving
  - Thermal storage technologies

IDEAS Center
Infrastructure, Design
Environment & Sustainability

SIBS
Sustainably Integrated Buildings and Sites Center

Carnegie Mellon University

CUNY The City University of New York

Appalachian Mountaineers

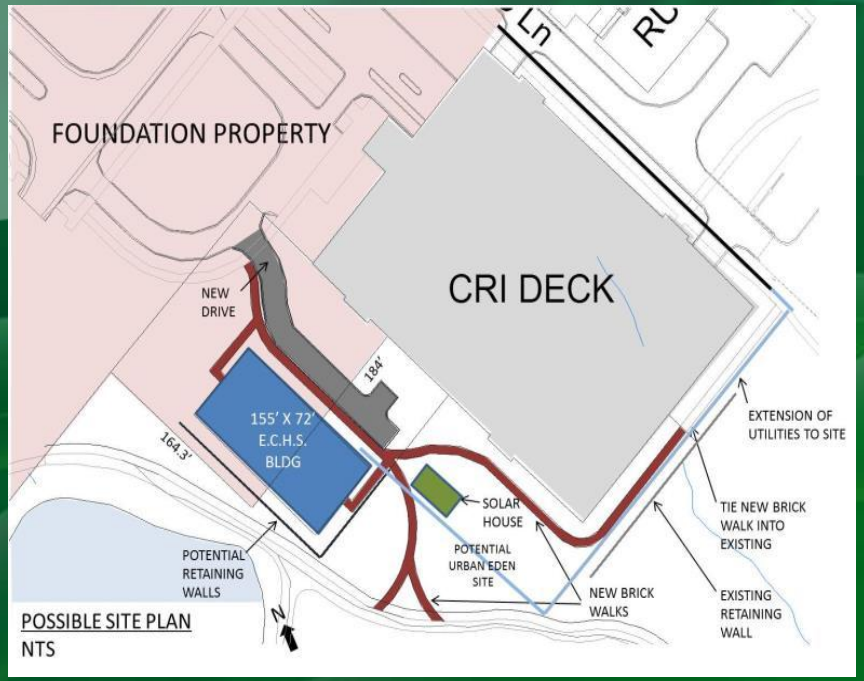
UNC CHARLOTTE
EPIC

Environmental Impact Lab -

- Expertise in:
  - Utility waste utilization and management, including coal and fly ash, nuclear waste
  - Waste to energy production
  - Water quality analysis
  - Air quality analysis
  - Waste water treatment for Natural Gas Fracking

Early College High School and Sustainable Park

- Partnership with Charlotte-Mecklenburg School System
- Grades 9-13
- STEM focus with energy concentration



UNC CHARLOTTE
EPIC